DOCUMENT RESUME

ED 409 758 HE 030 232

AUTHOR	LaBerge, Victoria Boller; And Others
TITLE	Awareness, Beliefs, and Classroom Practices of Mathematics Faculty at the Collegiate Level.
PUB DATE	Mar 97
NOTE	40p.; Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL, March 24-28, 1997).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150) -- Tests/Questionnaires (160)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*College Faculty; College Instruction; *Educational Attitudes; Educational Change; Higher Education; Mathematics; *Mathematics Instruction; *Mathematics Teachers; *Standards; Teaching Methods
IDENTIFIERS	Faculty Attitudes; NCTM Assessment Standards; NCTM Curriculum and Evaluation Standards; NCTM Professional Teaching Standards

ABSTRACT

This study examined mathematics instruction at the collegiate level, focusing on the beliefs of college mathematics faculty in regard to mathematics learning and teaching. Twenty-six mathematics faculty at seven Midwestern colleges and universities were interviewed about their views on mathematics, the nature of mathematical truths, and the acquisition of mathematical knowledge. Faculty were also asked to comment on reforms and standards proposed by the National Council of Teachers of Mathematics (NCTM), and to provide information about their current teaching methods. It was found that most of the faculty had low levels of awareness of NCTM reform efforts or proposed standards. However, the majority expressed at least some agreement with most of the proposed reforms and standards presented during the interview. The most common in-class activity reported by the faculty was students taking notes while the instructor lectured, while less common in-class activities included students using calculators, discussing solutions to mathematics problems, and learning through real-life applications. Most faculty indicated that they would like to use more in- and out-of-class activities that required students to think about and communicate mathematical ideas. A copy of the interview protocol is included. (Contains 14 references.) (MDM)

TM

Running head: AWARENESS, BELIEFS, AND CLASSROOM PRACTICES

Awareness, Beliefs, and Classroom Practices of Mathematics Faculty at the Collegiate Level

Victoria Boller LaBerge, Alan Zollman, and Linda R. Sons
Northern Illinois University
DeKalb, IL

Paper presented at the annual meeting of the American Educational Ressearch Association, Chicago, March 24-28, 1997.

Awareness, Beliefs, and Classroom Practices of Mathematics Faculty at the Collegiate Level

Beginning with the 1989 publication of *Everybody Counts: A Report to the Nation on the Future of Mathematics* (National Research Council [NRC]), *Reshaping College Mathematics* (Steen), and the *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics [NCTM]), there have been many calls for change in how mathematics is taught. Much of the reform (and research) emphasis has been at the K-12 level. The purpose of the current study was to investigate mathematics instruction at the collegiate level. The first objective was to gather information from college and university level mathematics faculty regarding their beliefs related to mathematics, mathematics learning, and mathematics teaching. A second objective was to determine the extent of these faculty members' knowledge or awareness of ongoing reform efforts, in particular faculty awareness of the NCTM *Standards* documents: *Curriculum and Evaluation Standards for School Mathematics* (1989), *Professional Standards for Teaching Mathematics* (1991), and *Assessment Standards for School Mathematics* (1995). A third objective was to investigate the classroom teaching practices employed by collegiate mathematics faculty.

Recent publications concerned with reforming mathematics curriculum and instruction have called for prospective teachers of mathematics to be taught in a manner consistent with how they will be expected to teach, that is, in a way consistent with the instructional practices recommended in the NCTM *Standards* Documents (e.g. Leitzel, 1991; NCTM, 1989, 1991; Schoenfeld, 1990). Such instructional practices, however, are not always aligned with the ways in which these prospective teachers were themselves taught mathematics in school, either at the K-12 or the college level. Previous research has shown that one's experiences as a learner of mathematics have an influence on the beliefs one holds related to mathematics, mathematics learning, and mathematics pedagogy (e.g., Edgerton, 1992, 1993; Sullivan, 1989; Sullivan & Leder, 1992; Wilcox, Lanier, Schram & Lappan, 1992).

As mentioned in *Reshaping College Mathematics* (Steen, 1989), the recommendations of the *Standards* represent a dramatic shift from the traditional college mathematics instructional model. A 1985-86 survey of mathematics teaching at the undergraduate level indicated that 99% of the instruction in five common introductory courses followed a lecture format (MAA Notes 7, referenced in Schoenfeld, 1990). In 1991 the NCTM commissioned an exploratory study of in-service (K-12) mathematics teachers' implementation of the NCTM *Curriculum and Evaluation Standards* and *Professional Standards for Teaching Mathematics* (Weiss, Upton & Nelson, 1992). The results of this pilot study were reported in: *The Road to Reform in Mathematics Education: How far have we traveled?* The question is now, how far have we traveled on the road to reform in mathematics at the collegiate level?

Methods

This investigation involved the collection of both qualitative and quantitative data. Twenty-six mathematics faculty at seven midwestern colleges and universities were interviewed. The individual interviews were approximately one hour in length. Each interview began with the faculty member discussing her or his views of mathematics, the nature of mathematical truths, the acquisition of mathematical knowledge, and whether mathematics is created or discovered. (See the Appendix for the complete interview protocol.)

The second portion of the interview used a modified version of the *Standards*' Beliefs Instrument [SBI] developed by Zollman and Mason (1992). The original SBI included 16 items that were either nearly exact quotes or the negation of exact quotes from the NCTM *Curriculum and Evaluation Standards*. Eight of the 16 items agreed with the *Standards,* and were considered to have positive valence; the remaining eight items disagreed with the *Standards*, and thus had negative valence. Therefore, if the items are summed to obtain a total score, the negative items are reverse scored to correspond with the positive items.

Zollman and Mason (1992) determined construct validity through: 1) expert panel of 17 mathematics educators (chi-squared = 229.79, df = 1, $p < .001$) and 2) convergent and divergent correlations. Reliability of the SBI was investigated with internal consistency using Spearman-Brown reliability and the coefficient of alpha (.803, coefficient of alpha approaching .79). The purpose of the SBI is to measure beliefs underlying the *Standards*, rather than assess comprehensive knowledge of specific aspects of the *Standards*. As such, the items of the SBI are intended to be representative of the *Standards*, not inclusive.

For the modified SBI, three items specific to Grades K-4 were deleted and were replaced with four items more appropriate to the collegiate level (Items 8, 9, 10, and 11). Three additional items (Items 17, 19, and 20) were included to determine if the faculty members made distinctions between public school (K-12) teaching and learning, and collegiate teaching and learning. Other items were also changed slightly, again to reflect the collegiate level. Thus, the modified SBI included a total of 20 items, 10 with positive valence and 10 with negative valence. Similarly to the procedure used with the original SBI, each faculty member was asked to indicate a level of agreement or disagreement with each item from a series of statements related to the underlying assumptions of the NCTM *Standards*. The items included in the modified SBI can be separated into three clusters: statements related to the nature of mathematics (Items 1, 3, 6, 7, 13, and 16); statements related to students and their learning of mathematics (Items 2, 8, 12, 15, 17, and 18); and statements related to the teaching of mathematics (Items 4, 5, 9, 10, 11, 14, 19, and 20). See the Appendix for a complete listing of the statements used in the modified SBI.

During the third section of the interview, the faculty members provided information about their current teaching methods. They were asked to indicate the frequency with which their students participated in 12 activities either in class, or as expected or required activities outside of class. Three of these activities can be considered traditional learning activities: working on exercises or problems from the textbook; working exercises or problems from teacher prepared worksheets, handouts, or problem sets; and (in class only) taking notes while the teacher or instructor lectures. The other nine activities are consistent with the philosophy underlying the NCTM *Standards* and include such activities as: using physical materials or models; learning mathematics from real-life applications of concepts and procedures; and working in groups. The items were based on items included in the 1991 NCTM-commissioned study (Weiss et al., 1992) which explored K-12 mathematics teachers' implementation of the NCTM *Standards* in their classroom teaching practices. (See the Appendix for a full list of the activities.)

The final portion of the interview asked about their knowledge of reform efforts and the *Standards* documents. Faculty also gave their views of their colleagues' levels of awareness of the *Standards* documents. The data collected is self-reported information; at this time, no classroom observations have been done.

Results

Awareness.

Results indicate that collegiate mathematics faculty have low levels of awareness of current reform efforts in general, and of the NCTM *Standards* documents in particular. Although 23 of the 26 faculty members who participated in the study had at least heard of the NCTM *Curriculum and Evaluation Standards for School Mathematics,* only four felt that they were "well-aware" of the contents of this document. The levels of faculty awareness were lower for the *Professional Standards for Teaching Mathematics,* and the *Assessment Standards for School Mathematics.* Thirteen faculty members indicated that they were "not aware of the *Professional Standards,*" with 10 giving the same response for the *Assessment Standards.* Once again, only four indicated that they were "well-aware" of these two documents. However, the level of faculty awareness of other reform publications was higher. Slightly more than half indicated that they had some level of awareness of publications related to the learning and teaching of mathematics at the collegiate level, such as *A Call for Change* (Leitzel, 1991), and *Reshaping College Mathematics* (Steen, 1989),

The participating faculty members were also asked about the levels of awareness of the other instructors within their departments. Responses related to the three *Standards* documents were similar. Around 40% of subjects were either uncertain or felt they had no basis for judging their colleagues' awareness of the *Standards* documents. This response was given most frequently by members of larger departments and by faculty from research institutions. Two of the 26 faculty indicated that their colleagues were "not at all aware" of the *Curriculum and Evaluation Standards;* the corresponding responses for the *Professional Standards* were three of 26, and for the *Assessment Standards,* four of 26. Between 42 and 54 percent of the participants felt that the other faculty within their departments had at least some awareness of the *Standards* documents (14, 12, and 11 out of 26, for the *Curriculum and Evaluation Standards;* the *Professional Standards;* and the *Assessment Standards,* respectively). However, the most common response was that the awareness of other faculty was "very limited." Two participants felt their colleagues were "well-aware" of the *Curriculum and Evaluation Standards.* An equal number gave the same response for the *Professional Standards,* while only one indicated his colleagues were "well-aware" of the *Assessment Standards.* These responses are somewhat curious, given the high numbers –greater than 40% for the *Professional* and *Assessment Standards*–of faculty who indicated that they themselves were not aware of these documents. Although they were not specifically asked, a number of the subjects indicated that faculty at their institutions were generally aware of other publications related to teaching and learning mathematics.

Beliefs.

Responses to the SBI show that overall, the collegiate mathematics faculty members interviewed generally agree with the underlying assumptions of the NCTM *Curriculum and Evaluation Standards*. For 12 of the 20 items included in this portion of the interview, a substantial number (22 or more out of 26) of the participants expressed at least some agreement (responses of somewhat agree, agree, or strongly agree) with the position of the *Standards*. On another four items, about twice as many of the faculty agreed as disagreed with the vision underlying the *Standards*. Roughly the same number of faculty agreed as disagreed with the *Standards*' philosophy on two items, although the number agreeing was slightly higher. On only two items, Items 9 and 14, did the number of faculty disagreeing with the underlying assumption of the *Standards* exceed the number agreeing. (Table 3 shows the number of collegiate mathematics faculty who agreed with the *Standards*' philosophy for each of the 20 items; the valence of each statement is also show in the table.) Thus, the collegiate mathematics faculty interviewed expressed at least some level of agreement with the position taken in the NCTM *Standards*. The faculty members also tended to agree with each other, and their responses did not appear to vary by the type of institution at which they taught. (See Table 2.)

Of the eight items on the SBI that had 25% or more of the collegiate mathematics faculty indicating disagreement with the philosophy of the *Standards,* three (Items 8, 17, and 18) were in the cluster related to students and learning mathematics. Two (Items 1 and 13) were in the mathematics cluster, and the three remaining items (Items 9, 10, and 14) were in the teaching cluster. The two statements for which there was more disagreement than agreement with the *Standards*' position were in this cluster. In opposition to the underlying assumptions of the *Standards,* nearly two-thirds of the study participants indicated that they agreed to least some extent with the statement: "Students NEED TO MASTER computation before going on to algebra [or algebraic skills before calculus]."

Sixty percent of those who responded to the item: "Appropriate calculators should be available to ALL STUDENTS at ALL TIMES," disagreed with the idea expressed in the statement. The *Standards'* position is agreement with this statement.

The observation that the collegiate mathematics faculty generally believe in the principles underlying the *Standards* is also supported by responses given to the open-ended questions related to the nature of mathematics from the first portion of the interview. Mathematics was described by the collegiate mathematics faculty as a means of "looking at, explaining, and understanding the way the world works." They talked of mathematics as a "tool," as the "science of pattern," and as a language for "communicating ideas." Reasoning and logic were essential in the validation and verification of truth in mathematics. In learning mathematics, the mathematics faculty mentioned the importance of both practice and reflection: "[students] need opportunities to practice [solving problems], but also to *think* [original emphasis]." They noted that students "learn [mathematics] through life experiences," and through solving problems connected to the "real world." Other mathematics faculty stated that students need opportunities, practice, and time "to fit in what they are learning with what they know and believe already."

Classroom practices.

In the third portion of the interview, the mathematics faculty responded to a series of items regarding their teaching practices. They were asked to indicate how frequently their undergraduate mathematics students participated in various activities either 1) in class, or 2) as expected or required activities outside of class. Where appropriate, the faculty were asked to respond to the same items while considering the activities for their graduate students. Only the responses relative to the undergraduate courses are presented here. The total number of responses for certain items may be more than 26 because some faculty members also made distinctions between upper and lower division courses at the undergraduate level.

Three of the 12 student activities listed can be considered traditional learning activities for mathematics courses. These are: working on exercises or problems from the textbook; working exercises or problems from teacher-prepared worksheets, handouts, or problem sets; and (in class only) taking notes while the teacher or instructor lectures. The remaining nine activities are consistent with recommendations from the NCTM *Standards*. Examples of the recommended activities for students are: using physical materials or models; learning mathematics from real-life applications of concepts and procedures; and working in groups. (For a complete list of the activities, see the Appendix.)

By far the most common in-class activity reported by the mathematics faculty was students taking notes while the teacher or instructor lectured. (See Table 4 for results.) Twenty-four of the faculty members indicated that they used this activity in undergraduate courses "most of the time" or "always." Only one professor responded that she rarely used lectures in her courses, while the one remaining faculty member reported sometimes using this activity. At least 27% of the faculty members indicated that they had their students participate in the following activities in class either "most of the time" or "always:" using calculators (12 of 27 responses); presenting or discussing solutions to mathematics problems (10 of 28); learning through real-life applications (9 of 28); making conjectures and exploring problem-solving methods (8 of 29); and working exercises or problems from the textbook (8 of 26). All of the activities *except* having students write about mathematics were used by one-third or more of the faculty at least sometimes. Nineteen of the 26 faculty members reported never or seldom having their undergraduate students write about mathematics as an in-class activity; 17 reported never or seldom having their students work in groups while in class, and the same number reported never or seldom having their students using computers during class time. In addition, 14 of the faculty members indicated that their students never or seldom used physical materials or models, and an equal number indicated that their students never or seldom worked on mathematics projects or open-ended investigations.

As noted previously, some of the faculty distinguished between lower and upper division mathematics courses. In-class activities which were more likely to be used for upper division courses as opposed to lower division courses were: using physical materials or models; learning through real-life applications; working in groups; using calculators; working on projects or open-ended investigations; and presenting or discussing solutions to mathematics problems. These are all activities which are consistent with the *Standards*' recommendations. The faculty reported that they were more likely to have students in lower division rather than upper division courses working on exercises or problems from teacher-prepared worksheets, handouts, or problem sets while in class. Responses for one activity–making conjectures and exploring problem-solving methods–were mixed; some faculty indicated they were more likely to use this as an in-class activity with students in upper division courses, while others indicated they were more likely to have students in lower division courses do this activity.

Generally, there were fewer responses related to activities expected or required of undergraduate students outside of class. The most commonly used outside-of-class activity reported by the mathematics faculty was students working exercises or problems from the textbook. (See Table 5 for complete outside-of-class activity results.) Nearly all of the faculty who responded to this item (24 out of 25) indicated that their students were expected or required to do homework from the text "most of the time" or "always." Fifteen of 24 reported their students used calculators "most of the time" or "always" outside of class. Of the nine remaining activities, six were expected or required of students at least sometimes by half or more of the faculty who responded. Three activities were infrequently used by the mathematics faculty in their undergraduate courses. The faculty indicated that they never or seldom expected or required their students to use physical materials or models (15 out of

28); to write about mathematics (16 of 23); or to present or discuss solutions to mathematics problems as outside-of-class activities (11 of 20). Students taking notes while the teacher lectures is not applicable as an outside-of-class activity and is not included in these results. Many of the mathematics faculty interviewed for this study indicated that they *encouraged*, rather than expected or required, students to do some of these activities. In particular, some faculty noted that they encouraged their students to work together in groups outside of class.

Outside-of-class activities that were more likely to be used for upper division courses rather than lower division courses were: using physical materials or models; working exercises or problems from teacher-prepared worksheets, handouts, or problems sets; learning through real-life applications; working in groups; making conjectures and exploring problem-solving methods; and working on projects or open-ended investigations. All of these *except* working exercises or problems from teacher-prepared worksheets, handouts, or problems sets are activities consistent with the *Standards*' recommendations. There were no differences in reported outside-of-class activities for upper division as compared with lower division courses for the other items.

When asked which of these activities they would like to have their students participate in more frequently, the collegiate mathematics faculty indicated many of the activities associated with the NCTM *Standards*' recommendations. For in-class activities the faculty members emphasized their desire to use more activities which required their undergraduate students to think about and communicate mathematical ideas: presenting and discussing solutions to problems; making conjectures and exploring problem-solving methods; working in groups; working on projects and investigations; and writing about mathematics. Some of these were linked with other activities: using physical materials and models was linked with understanding and communicating solutions to problems; and using real-world applications that were relevant to the students' daily lives was linked to work on projects and investigations. Using technology (calculators and computers) more effectively was also mentioned by many of the faculty.

The outside-of-class activities which the faculty indicated that they would like their students to participate in more frequently were very similar to the in-class activities. These activities were primarily related to thinking about and communicating mathematical ideas: presenting and discussing solutions to problems; making conjectures and exploring problem-solving methods; working in groups; working on projects and investigations; and writing about mathematics. In addition, the faculty believed their students should do the following activities outside of class: read their mathematics textbooks more carefully; use the library and other resources; ask more questions of themselves, their classmates, and their instructors; work more exercises and problems to get the skills practice they need; and use technology as a tool for learning mathematics.

During the interviews some faculty members commented that these expectations "are perhaps unrealistic" because students "haven't been taught to be self-sufficient" in learning mathematics. At the same time, others noted students should be "curious" and students should "*naturally* [original emphasis] do these types of things" without prompting from their instructors. One professor stated "I am a firm believer in the old adage that you must spend at least two to three hours working [on mathematics] outside of class for every hour spent in class."

The mathematics faculty were also asked "what would you say are the barriers (constraints) to your implementation and use of these types of activities?" Nineteen of the 26 faculty members interviewed mentioned the time involved in using these activities as a barrier or constraint. This included time spent both in class and outside of class. For 10 of the faculty, the amount of time required was given as the most important reason for not using the activities more frequently. Other frequently mentioned barriers or constraints were: lack of resources (mentioned by 11 out of the 26 faculty); curriculum content (8 of

26); class size (10 of 26); and students' negative beliefs and expectations related to mathematics (5 of 26). For three faculty members class size was the most important reason for not using the desired activities, with an equal number indicating that the negative beliefs and expectations of students was their primary reason for avoiding the activities. There were other factors linked with the students which served as barriers or constraints for some faculty members. These included: ability level, lack of motivation and interest, poor preparation and background, lack of homogeneity in preparation, poor study skills and efforts, and scheduling problems (especially for using group work or projects). Two faculty members mentioned their "own conservatism" as a factor influencing their implementation and use of the activities, and two stated that "good teaching [was] not rewarded" or "valued" as much as research at their institutions, and thus, any additional time spent on teaching would be "wasted." Both of the latter faculty members indicated that they were disturbed by this situation. Others noted that under the established grading system "learning is not rewarded or valued" but rather "completing courses is what is important."

Discussion

How mathematics is taught at the collegiate level is a concern to the post secondary population and the mathematics education community. Most of the emphasis for reform and research has been at the public school level. By focusing on mathematics instruction at the post secondary level, this study adds to the understanding of the teaching and learning of mathematics and the implications for efforts at reforming instruction at all levels.

That collegiate mathematics faculty members have greater awareness of reform publications from organizations such as the MAA and the NRC than the NCTM *Standards* documents is not surprising, as these are the more "natural" organizations for collegiate mathematics faculty. However, the overall level of awareness of reform documents for the participating faculty members was low.

When questioned about the level of awareness of the other instructors within their departments, around 40% of the faculty members interviewed were either uncertain or felt they had no basis for making a judgment in this regard. Members of larger departments and faculty from the research institutions gave this response more frequently than other faculty members. This may be an indication that topics of this nature are not discussed within such departments.

To the extent that they are aware of the NCTM *Standards*, many collegiate faculty members have a favorable impression of the suggestions and recommendations included in the *Standards* documents. Moreover, many of their stated beliefs about mathematics, how it is learned, and how it should be taught coincide with the underlying assumptions of the *Standards*, as measured by the SBI. However, this appears not to have transferred to their teaching practices; the data collected relative to classroom teaching practices indicate that the traditional mode of instruction–students taking notes while the teacher lectures–is still the most frequently used method at the collegiate level. Nearly all of the faculty members who participated in the study (24 out of 26) indicated that they employed the lecture method "most of the time" or "always" in their undergraduate mathematics courses.

Although the more traditional modes of instruction are still common in collegiate mathematics courses, there are indications that this may be changing. More than half of the faculty members reported that their students participated in six out of the nine activities consistent with the *Standards* at least sometimes. The collegiate mathematics faculty indicated that they would like to use more in- and out-of-class activities that require their undergraduate students to think about and communicate mathematical ideas. They felt their students should be expected or required to do the following as regular activities both in class and outside of class: present and discuss solutions to problems; make conjectures and explore problem-solving methods; work in groups; work on projects and investigations; and write and talk about mathematics. Other outside-of-class activities that the faculty believed their students should do include: reading their mathematics textbooks more carefully; using the library and other resources; asking more questions of themselves, their classmates, and their instructors; working more exercises and problems to get the skills practice they need; and using technology as a tool for learning mathematics.

Some faculty members noted during the interviews, that such expectations for students may be "unrealistic". However, the faculty did report using these activities, which are consistent with the *Standards*' recommendations, more frequently in upper division rather than lower division mathematics courses. This may indicate a belief that these activities are more important or more appropriate for advanced mathematics students, or the fact that it may be easier or less risky to implement these changes at the advanced course level.

The amount of time required to do these activities–both in and out of class–was the most common reason given by the faculty for not using the activities more frequently. Other frequently mentioned barriers or constraints were: lack of resources; curriculum content; class size; and students' negative beliefs and expectations related to mathematics. There were other factors linked with the students, and the faculty members themselves or their institutions, that served as barriers or constraints for some faculty members.

The first stage in improving mathematics instruction at any level is awareness of current teaching practices, followed by an acknowledgment that there may be better alternative methods. This sense that there is a reason to change, whether it is a level of dissatisfaction with current practice or a belief that these alternatives can provide better learning for students, must outweigh the risk involved with change. The next stages require reflection, discussion, mentoring, and a meaningful level of success.

It is encouraging that the responses of the collegiate mathematics faculty interviewed revealed concern for students' learning, desire to improve teaching practices, and beliefs that are generally consistent with the view of the NCTM *Standards*. It is also encouraging that, overall, the faculty members' responses did not show a dislike or distrust of the *Standards* documents themselves, and for the philosophy of learning and teaching mathematics that they represent. This shows that collegiate mathematics instruction has started down "the road to reform in mathematics education."

Much more research remains to be done in this area. Questions that need to be considered include: 1) What impact will the implementation of the NCTM *Standards* in Grades K-12 have on teaching at the college or university level? Will students whose learning experiences reflect the *Standards* have different expectations and beliefs about mathematics? 2) What impact will calculus reform have on collegiate curriculum and teaching practices? 3) How can collegiate mathematics instructors make more efficient use of the time available to them? 4) How can collegiate mathematics instructors make more efficient or effective use of the technology available to them? 5) How can collegiate mathematics faculty overcome the other barriers they face in changing their teaching? What support do they need while they try new teaching methods?

References

Edgerton, R. T. (1992, April). A description of the assessment practices of teachers who have begun to implement the instructional practices suggested in the NCTM Standards documents. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Edgerton, R. T. (1993, April). The emerging implementer of the NCTM Standards: Concepts searching for expression. Paper presented at the annual meeting of the American Educational Research Association, Atlanta, GA.

Leitzel, J. R. C. (Ed.) (1991). A Call for Change: Recommendations for the mathematical preparation of teachers of mathematics (An MAA Report). Washington, DC: The Mathematical Association of America.

National Council of Teachers of Mathematics [NCTM] (1989). Curriculum and Evaluation Standards for School Mathematics. Reston, VA: Author.

National Council of Teachers of Mathematics (1991). Professional Standards for Teaching Mathematics. Reston, VA: Author.

National Council of Teachers of Mathematics (1995). Assessment Standards for School Mathematics. Reston, VA: Author.

National Research Council (1989). Everybody Counts: A report to the nation on the future of mathematics education. Washington, DC: National Academy Press.

Schoenfeld, A. (Ed.) (1990). A Source Book for College Mathematics Teaching (An MAA Report). Washington, DC: The Mathematical Association of America.

Steen, L. A. (Ed.) (1989). Reshaping College Mathematics (MAA Notes 13). Washington, DC: The Mathematical Association of America.

Sullivan, P. (1989). Factors inhibiting change–A case study of a beginning primary teacher. Mathematics Education Research Journal, 1 (2), 1-16.

Sullivan, P., & Leder, G. C. (1992). Students' influence on novice Australian teachers' thoughts and actions regarding mathematics teaching: Two case studies. The Elementary School Journal, 92 (5), 621-642.

Weiss, I. R., Upton, J., & Nelson, B. (1992). The road to reform in mathematics education: How far have we traveled? Reston, VA: NCTM with funding from the Exxon Education Foundation.

Wilcox, S. K., Lanier, P., Schram, S., & Lappan, G. (1992). Influencing beginning teachers' practice in mathematics education: Confronting constraints of knowledge, beliefs, and context (Research Report 92-1). East Lansing, MI: The National Center for Research on Teacher Learning, Michigan State University.

Zollman, A., & Mason, E. (1992). The *Standards*' Beliefs Instrument (SBI): Teachers' Beliefs About the NCTM *Standards*. School Science and Mathematics, 92(7), 359-364.

Table 1
Collegiate mathematics faculty responses to the SBI, raw data.

<table>
<tr><th>ITEM</th><th>Strongly Disagree</th><th>Disagree</th><th>Somewhat Disagree</th><th>Somewhat Agree</th><th>Agree</th><th>Strongly Agree</th></tr>
<tr><td>1. Problem solving should be a SEPARATE, DISTINCT part of the mathematics curriculum.</td><td>|||||||||
|
*</td><td>|||||||</td><td>||</td><td>|||</td><td>|||</td><td>|</td></tr>
<tr><td>2. Students should share (discuss) their problem-solving approaches WITH OTHER STUDENTS.</td><td></td><td></td><td></td><td>||</td><td>||||||||</td><td>|||||||||
|||||||
*</td></tr>
<tr><td>3. Mathematics can be thought of as a language that must be MEANINGFUL if students are to communicate and apply mathematics productively.</td><td></td><td>||</td><td>|</td><td>||</td><td>|||||</td><td>|||||||||
|||||||
*</td></tr>
<tr><td>4. A major goal of mathematics instruction is to help students develop the belief that THEY HAVE THE POWER to control their own success in mathematics.</td><td></td><td>||</td><td></td><td>|||||||</td><td>|||||||||</td><td>||||||||
*</td></tr>
<tr><td>5. Students should be required to justify their solutions, thinking, and conjectures in ONLY ONE way.</td><td>|||||||||
||||||||
*</td><td>|||||</td><td>||</td><td>|</td><td></td><td></td></tr>
<tr><td>6. The study of mathematics should include opportunities for using mathematics in OTHER SUBJECT AREAS.</td><td></td><td>|</td><td></td><td>||||||</td><td>||||||||||</td><td>|||||||||
*</td></tr>
<tr><td>7. The mathematics curriculum consists of several discrete strains such as algebra, analysis, and topology which can best be taught in ISOLATION.</td><td>||||||||
*</td><td>||||||||</td><td>||||||</td><td>|||</td><td>|</td><td></td></tr>
<tr><td>8. Virtually all students CAN LEARN to think mathematically.</td><td>||||</td><td>||</td><td>||</td><td>|</td><td>||||||||||
|</td><td>||||||
*</td></tr>
<tr><td>9. Students NEED TO MASTER computation before going on to algebra [or algebraic skills before calculus].</td><td>*</td><td>||||||||</td><td></td><td>|||</td><td>||||||||</td><td>||||||</td></tr>
<tr><td>10. Early use of calculators WILL INHIBIT learning basic mechanical skills.</td><td>|||
*</td><td>||||||||</td><td>|||</td><td>|||</td><td>||||</td><td>||||</td></tr>
</table>

* indicates NCTM position

Table 1 (continued)
Collegiate mathematics faculty responses to the SBI, raw data.

ITEM	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
11. The PRIMARY PURPOSE of mathematics instruction is to prepare students for further study in mathematics.	IIII *	IIIIIIIIII IIIII	IIII	III		
12. Learning mathematics is a process in which students ABSORB INFORMATION, storing it in easily retrievable fragments as a result of repeated practice and reinforcement.	IIIIII *	IIIIIIIIII I	IIIIII		II	I
13. Mathematics SHOULD be thought of as a COLLECTION of concepts, skills, and algorithms.	III *	IIIIIIIII	IIIII	IIIII	IIII	
14. Appropriate calculators should be available to ALL STUDENTS at ALL TIMES.	IIIIII	IIII	IIIII	II	III	IIIII *
15. Learning mathematics must be an ACTIVE PROCESS.					IIII	IIIIIIIII IIIIIIIII IIII *
16. A demonstration of good reasoning should be valued EVEN MORE than the ability to find correct answers.	I		II	II	IIIIIIIIII II	IIIIIIIII *
17. Students ENTER COLLEGE with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills.		IIIIII	III	IIIIII	IIIII	IIIIII *
18. Students ENTER KINDERGARTEN with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills.	IIIII	IIII	III	IIIII	IIIII	IIII *
19. The major responsibility of a college mathematics instructor is to PRESENT INFORMATION.	IIIIII *	IIIIIIIIII II	IIII	I	II	I
20. The major responsibility of a public school mathematics teacher is to PRESENT INFORMATION.	IIIIII *	IIIIIIIIII II	IIII	III	I	

* indicates NCTM position

Table 2
Collegiate mathematics faculty responses to the SBI by type of institution.

ITEM	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
1. Problem solving should be a SEPARATE, DISTINCT part of the mathematics curriculum.	Δ †††† ◊◊◊ *	◊◊◊◊◊◊◊	† ◊	Δ ◊◊	† ◊◊	◊
2. Students should share (discuss) their problem-solving approaches WITH OTHER STUDENTS.				† ◊	†† ◊◊◊◊◊◊	ΔΔ †††† ◊◊◊◊◊◊◊◊ ◊◊ *
3. Mathematics can be thought of as a language that must be MEANINGFUL if students are to communicate and apply mathematics productively.		† ◊	◊	† ◊	†† ◊◊◊	ΔΔ ††† ◊◊◊◊◊◊◊◊ ◊◊◊ *
4. A major goal of mathematics instruction is to help students develop the belief that THEY HAVE THE POWER to control their own success in mathematics.		† ◊		◊◊◊◊◊◊◊	Δ †††† ◊◊◊◊	Δ †† ◊◊◊◊◊ *
5. Students should be required to justify their solutions, thinking, and conjectures in ONLY ONE way.	Δ †††††† ◊◊◊◊◊◊◊◊ ◊◊◊ *	Δ † ◊◊◊	◊◊	◊		
6. The study of mathematics should include opportunities for using mathematics in OTHER SUBJECT AREAS.		†		◊◊◊◊◊◊	Δ ††† ◊◊◊◊◊◊	Δ ††† ◊◊◊◊◊ *
7. The mathematics curriculum consists of several discrete strains such as algebra, analysis, and topology which can best be taught in ISOLATION.	Δ †††† ◊◊◊ *	†† ◊◊◊◊◊◊	Δ ◊◊◊◊◊	† ◊◊	◊	
8. Virtually all students CAN LEARN to think mathematically.	†† ◊◊	◊◊	◊◊	◊	ΔΔ †††† ◊◊◊◊◊	† ◊◊◊◊◊ *
9. Students NEED TO MASTER computation before going on to algebra [or algebraic skills before calculus].	*	Δ †††† ◊◊◊		† ◊◊	†† ◊◊◊◊◊◊	Δ ◊◊◊◊◊
10. Early use of calculators WILL INHIBIT learning basic mechanical skills.	Δ †† *	††† ◊◊◊◊◊	◊◊◊	◊◊◊	†† ◊◊	Δ ◊◊◊

* indicates NCTM position; Δ indicates a faculty member from a two-year college; † four-year college; ◊ a research university

Table 2 (continued)
Collegiate mathematics faculty responses to the SBI by type of institution.

ITEM	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
11. The PRIMARY PURPOSE of mathematics instruction is to prepare students for further study in mathematics.	Δ † ◊◊ *	Δ †††††† ◊◊◊◊◊◊◊◊	◊◊◊◊	◊◊◊		
12. Learning mathematics is a process in which students ABSORB INFORMATION, storing it in easily retrievable fragments as a result of repeated practice and reinforcement.	Δ † ◊◊◊◊ *	††††† ◊◊◊◊◊◊	Δ † ◊◊◊◊		◊◊	◊
13. Mathematics SHOULD be thought of as a COLLECTION of concepts, skills, and algorithms.	Δ † ◊ *	†††† ◊◊◊◊◊	Δ † ◊◊◊	◊◊◊◊◊	† ◊◊◊	
14. Appropriate calculators should be available to ALL STUDENTS at ALL TIMES.	Δ ◊◊◊◊◊	◊◊◊◊	††† ◊◊	◊◊	†† ◊	Δ †† ◊◊ *
15. Learning mathematics must be an ACTIVE PROCESS.					Δ †† ◊	Δ ††††† ◊◊◊◊◊◊◊◊ ◊◊◊◊◊◊◊◊ *
16. A demonstration of good reasoning should be valued EVEN MORE than the ability to find correct answers.	◊		◊◊	◊◊	Δ †††† ◊◊◊◊◊◊◊	Δ ††† ◊◊◊◊◊ *
17. Students ENTER COLLEGE with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills.		Δ † ◊◊◊◊	Δ ††	† ◊◊◊◊◊	† ◊◊◊◊	†† ◊◊◊◊ *
18. Students ENTER KINDERGARTEN with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills.	Δ †† ◊◊	◊◊◊◊	◊◊◊	Δ † ◊◊◊	††† ◊◊	† ◊◊◊ *
19. The major responsibility of a college mathematics instructor is to PRESENT INFORMATION.	††† ◊◊◊ *	Δ †††† ◊◊◊◊◊◊◊	Δ ◊◊◊	◊	◊◊	◊
20. The major responsibility of a public school mathematics teacher is to PRESENT INFORMATION.	††† ◊◊◊ *	Δ †††† ◊◊◊◊◊◊◊	Δ ◊◊◊	◊◊◊	◊	

* indicates NCTM position; Δ indicates a faculty member from a two-year college; † a four-year college; ◊ a research university

Table 3
Number of collegiate mathematics faculty matching the underlying position of the NCTM *Curriculum and Evaluation Standards* (Valence of statement).

ITEM	Match	Conflict
2. Students should share (discuss) their problem-solving approaches WITH OTHER STUDENTS. (+)	26	0
15. Learning mathematics must be an ACTIVE PROCESS. (+)	26	0
5. Students should be required to justify their solutions, thinking, and conjectures in ONLY ONE way. (-)	25	1
6. The study of mathematics should include opportunities for using mathematics in OTHER SUBJECT AREAS. (+)	25	1
4. A major goal of mathematics instruction is to help students develop the belief that THEY HAVE THE POWER to control their own success in mathematics. (+)	24	2
3. Mathematics can be thought of as a language that must be MEANINGFUL if students are to communicate and apply mathematics productively. (+)	23	3
11. The PRIMARY PURPOSE of mathematics instruction is to prepare students for further study in mathematics. (-)	23	3
12. Learning mathematics is a process in which students ABSORB INFORMATION, storing it in easily retrievable fragments as a result of repeated practice and reinforcement. (-)	23	3
16. A demonstration of good reasoning should be valued EVEN MORE than the ability to find correct answers. (+)	23	3
7. The mathematics curriculum consists of several discrete strains such as algebra, analysis, and topology which can best be taught in ISOLATION. (-)	22	4
19. The major responsibility of a college mathematics instructor is to PRESENT INFORMATION. (-)	22	4
20. The major responsibility of a public school mathematics teacher is to PRESENT INFORMATION. (-)	22	4
1. Problem solving should be a SEPARATE, DISTINCT part of the mathematics curriculum. (-)	19	7
8. Virtually all students CAN LEARN to think mathematically. (+)	18	8
13. Mathematics SHOULD be thought of as a COLLECTION of concepts, skills, and algorithms. (-)	17	9
17. Students ENTER COLLEGE with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills. (+)	17	9
10. Early use of calculators WILL INHIBIT learning basic mechanical skills. (-)	14	11
18. Students ENTER KINDERGARTEN with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills. (+)	14	12
14. Appropriate calculators should be available to ALL STUDENTS at ALL TIMES. (+)	10	15
9. Students NEED TO MASTER computation before going on to algebra [or algebraic skills before calculus]. (-)	8	17

Table 4
Number of collegiate mathematics faculty using particular activities in class (by frequency level).

Activity	"Never" or "Seldom"	"Sometimes"	"Most of the time" or "Always"
1. Work problems from the textbook	13	5	8
2. Use physical materials or models	14^{L}	12^{U}	1
3. Work exercises or problems from worksheets, handouts, or problem sets	12^{U}	10	6^{L}
4. Learn through real-life applications	5	14	$9^{L, U}$
5. Work in groups	17^{L}	8	2^{U}
6. Make conjectures and explore problem-solving methods	$10^{L, U, O}$	11	$8^{U, G}$
7. Use calculators	5	10	$12^{L, U}$
8. Work on projects and open-ended investigations	14	11^{L}	3^{U}
9. Take notes during teacher's lecture	1	1	24
10. Write about mathematics	19	6	1
11. Use computers	17	8	1
12. Present or discuss solutions to mathematics problems	7	11^{L}	10^{U}

L = Lower division courses; U = Upper division courses; G = Geometry; O = Courses other than geometry

Table 5
Number of collegiate mathematics faculty expecting or requiring their students to do particular activities outside of class (by frequency level).

Activity	"Never" or "Seldom"	"Sometimes"	"Most of the time" or "Always"
1. Work problems from the textbook	0	1	24
2. Use physical materials or models	15^{L}	11^{L}	2^{U}
3. Work exercises or problems from worksheets, handouts, or problem sets	6^{L}	13	7^{U}
4. Learn through real-life applications	4	15^{L}	$6^{L, U}$
5. Work in groups	7^{L}	12	4^{U}
6. Make conjectures and explore problem-solving methods	10^{L}	9^{U}	6^{U}
7. Use calculators	2	7	15
8. Work on projects and open-ended investigations	11	12^{L}	3^{U}
9. Take notes during teacher's lecture	NA	NA	NA
10. Write about mathematics	16	4	3
11. Use computers	10	9	4
12. Present or discuss solutions to mathematics problems	11	6	3

L = Lower division courses; U = Upper division courses; G = Geometry; O = Courses other than geometry; NA = Not applicable

Appendix

Interview Protocol

[INTRODUCTION]

Interviewer:
- Thank faculty member BY NAME for agreeing to participate in this interview.
- Tell the faculty member the objective of the study is to GATHER INFORMATION from college and university level mathematics faculty regarding their views of mathematics, mathematics learning and mathematics teaching.
- Let her/him know "there are no CORRECT responses. We/I only ask that you be as open and complete as possible with your responses."
- Assure her/him "no responses or nor research results will be associated or identified with you <u>by name</u>."
- The length of time required for the interview is estimated to be 45 minutes (possibly as long as one hour).
- "Please be aware you are free to end the interview at any time should you decide you do not wish to continue."
- Let her/him know you will be taking notes throughout the interview.
- Ask "since we will be interviewing other faculty members in this department, we would ask that you not discuss your responses or the questions with your colleagues until we have completed all of the interviews scheduled (to avoid unintentionally influencing the results)."

[Go to PART I.]

[PART I: BELIEFS ABOUT MATHEMATICS]

Interviewer: The first items ask you to think about your views of mathematics.

1. If an undergraduate student were to ask you "What is mathematics?", how might you respond? [If necessary, suggest beginning calculus student as undergraduate (lower division) student.]

2. If an undergraduate student were to ask you "How do you know when something is true in mathematics? [How can you tell? or how do you decide?]", how might you respond?

3. If an undergraduate student were to ask you "How do students acquire mathematical knowledge?", how might you respond?

4. If an undergraduate student were to ask you "Is mathematics created or discovered?", how might you respond?

[PART I continued]

Interviewer: "At this time, I will read a series statements regarding mathematics, mathematics learning, and mathematics teaching. Listen to each statement carefully and select the response (1, 2, 3, 4, 5, or 6) that is the most accurate or best reflects your beliefs about mathematics, mathematics learning and mathematics teaching. A statement rated as a 6 (six) would indicate that you strongly agree with the statement. A rating of 1 (one) indicates that you strongly disagree with the statement."

- Give copies of the statements to the faculty member to read along with you.

	Strongly Disagree					Strongly Agree
1. Problem solving should be a SEPARATE, DISTINCT part of the mathematics curriculum.	1	2	3	4	5	6
2. Students should share (discuss) their problem-solving approaches WITH OTHER STUDENTS.	1	2	3	4	5	6
3. Mathematics can be thought of as a language that must be MEANINGFUL if students are to communicate and apply mathematics productively.	1	2	3	4	5	6
4. A major goal of mathematics instruction is to help students develop the belief that THEY HAVE THE POWER to control their own success in mathematics.	1	2	3	4	5	6
5. Students should be required to justify their solutions, thinking, and conjectures in ONLY ONE way.	1	2	3	4	5	6
6. The study of mathematics should include opportunities for using mathematics in OTHER SUBJECT AREAS.	1	2	3	4	5	6
7. The mathematics curriculum consists of several discrete strains such as algebra, analysis, and topology which can best be taught in ISOLATION.	1	2	3	4	5	6
8. Virtually all students CAN LEARN to think mathematically.	1	2	3	4	5	6
9. Students NEED TO MASTER computation before going on to algebra. [or algebraic skills before calculus]	1	2	3	4	5	6
10. Early use of calculators WILL INHIBIT learning basic mechanical skills.	1	2	3	4	5	6

	Strongly Disagree					Strongly Agree
11. The PRIMARY PURPOSE of mathematics instruction is to prepare students for further study in mathematics.	1	2	3	4	5	6
12. Learning mathematics is a process in which students ABSORB INFORMATION, storing it in easily retrievable fragments as a result of repeated practice and reinforcement.	1	2	3	4	5	6
13. Mathematics SHOULD be thought of as a COLLECTION of concepts, skills, and algorithms.	1	2	3	4	5	6
14. Appropriate calculators should be available to ALL STUDENTS at ALL TIMES.	1	2	3	4	5	6
15. Learning mathematics must be an ACTIVE PROCESS.	1	2	3	4	5	6
16. A demonstration of good reasoning should be valued EVEN MORE than the ability to find correct answers.	1	2	3	4	5	6
17. Students ENTER COLLEGE with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills.	1	2	3	4	5	6
18. Children ENTER KINDERGARTEN with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills.	1	2	3	4	5	6
19. The major responsibility of a college mathematics instructor is to PRESENT INFORMATION.	1	2	3	4	5	6
20. The major responsibility of a public school mathematics teacher is to PRESENT INFORMATION.	1	2	3	4	5	6

[Go to PART II.]

[PART II: CLASSROOM PRACTICES]

For the next set of items, please respond by indicating how frequently YOUR STUDENTS participate in a) these activities IN CLASS or b) as expected or required activities OUTSIDE OF CLASS.

- [Interviewer mark an 'a' on the scale for IN CLASS response, and 'b' for OUTSIDE OF CLASS response. If necessary and appropriate, make a distinction between lower (a1) and upper (a2) division undergraduate courses. Use a beginning calculus course as an example of a lower division course if necessary. Give the faculty member a copy of the statements to read long with you.]

How frequently do your UNDERGRADUATE students:

1. ...work exercises or problems from the textbook?

Never — Seldom — Sometimes — Most of the time — Always

2. ...use physical materials or models?

Never — Seldom — Sometimes — Most of the time — Always

3. ...work exercises or problems from a worksheet or handout? [or a problem set]

Never — Seldom — Sometimes — Most of the time — Always

4. ...learn mathematics from real-life applications of concepts or procedures?

Never — Seldom — Sometimes — Most of the time — Always

5. ...work in groups?

Never — Seldom — Sometimes — Most of the time — Always

6. ...make conjectures and explore problem-solving methods?

Never | Seldom | Sometimes | Most of the time | Always

7. ...use calculators?

Never | Seldom | Sometimes | Most of the time | Always

8. ...work on mathematics projects or open-ended investigations?

Never | Seldom | Sometimes | Most of the time | Always

9. ...take notes while the teacher lectures?

Never | Seldom | Sometimes | Most of the time | Always

10. ...write about mathematics?

Never | Seldom | Sometimes | Most of the time | Always

11. ...use computers?

Never | Seldom | Sometimes | Most of the time | Always

12. ...present or discuss solutions to mathematics problems?

Never | Seldom | Sometimes | Most of the time | Always

Comments:

How frequently do your GRADUATE students:

13. ...work exercises or problems from the textbook?

Never	Seldom	Sometimes	Most of the time	Always

14. ...use physical materials or models?

Never	Seldom	Sometimes	Most of the time	Always

15. ...work exercises or problems from a worksheet or handout? [or a problem set]

Never	Seldom	Sometimes	Most of the time	Always

16. ...learn mathematics from real-life applications of concepts or procedures?

Never	Seldom	Sometimes	Most of the time	Always

17. ...work in groups?

Never	Seldom	Sometimes	Most of the time	Always

18. ...make conjectures and explore problem-solving methods?

Never	Seldom	Sometimes	Most of the time	Always

19. ...use calculators?

Never | Seldom | Sometimes | Most of the time | Always

20. ...work on mathematics projects or open-ended investigations?

Never | Seldom | Sometimes | Most of the time | Always

21. ...take notes while the teacher lectures?

Never | Seldom | Sometimes | Most of the time | Always

22. ...write about mathematics?

Never | Seldom | Sometimes | Most of the time | Always

23. ...use computers?

Never | Seldom | Sometimes | Most of the time | Always

24. ...present or discuss solutions to mathematics problems, or proofs for theorems?

Never | Seldom | Sometimes | Most of the time | Always

Comments:

25. To the extent that you have used some of these types of activities in your classroom, please give an EXAMPLE(s) OF AN ACTIVITY that involves...exploration of problem-solving methods. ...[Interviewer ASK for examples as you go through questions 1 through 22 above, and INCLUDE ANY OF THE ACTIVITIES FROM ABOVE FOR WHICH AN EXTREME (WHETHER POSITIVE OR NEGATIVE) RESPONSE WAS GIVEN.]

26. a. Are there some of these activities that you WOULD LIKE to have your students involved in more frequently? Please list (indicate) which activities.

b. Are there some of these activities you feel students should do on their own? (I.e., that it is their responsibility to do without prompting or direction from you?)

27. What would you say are the barriers (constraints) to your implementation and use of these types of activities? (Mark or list as many as apply. If possible, rank the factors in order of their importance; "1" being the greatest barrier, and so forth.)

______ time constraints

______ lack of support from other faculty

______ lack of support from the administration

______ lack of resources

______ lack of information about activities

______ classroom management problems

______ testing/assessment requirements

______ curricular constraints

______ class size too large

______ other (Please explain.)

Comments:

28. a. In your opinion, have the mathematical background experiences of beginning college students changed from ten years ago?

b. In what ways have they changed?

c. What do you think are the major reasons for this change?

d. In your opinion, have the mathematical background experiences of beginning graduate students changed from ten years ago?

e. In what ways have they changed?

f. What do you think are the major reasons for this change?

Comments:

[Go to PART III.]

[PART III: AWARENESS OF NCTM STANDARDS]

Interviewer: At this time, I'd like to ask you a few questions related to the "Standards Documents" developed and published by the National Council of Teachers of Mathematics.

1. Are you aware of the National Council of Teachers of Mathematics, also referred to as the NCTM?

2. Are you aware that the National Council of Teachers of Mathematics has prepared *Curriculum and Evaluation Standards for School Mathematics* (1989), generally called the "NCTM Standards," for mathematics instruction?

______ Yes, I am very well aware of the Standards.

______ Yes, I have read parts of the Standards, or have read about the Standards.

______ Yes, I have heard of the Standards, but I don't know very much about them.

______ No, I am not aware of the Standards.

Comments:

3. Are you aware that the National Council of Teachers of Mathematics has prepared *Professional Standards for Teaching Mathematics* (1991), generally called the "NCTM Professional Teaching Standards," for mathematics teaching?

______ Yes, I am very well aware of the Professional Teaching Standards.

______ Yes, I have read parts of the Professional Teaching Standards, or have read about the Professional Teaching Standards.

______ Yes, I have heard of the Professional Teaching Standards, but I don't know very much about them.

______ No, I am not aware of the Professional Teaching Standards.

Comments:

4. Are you aware that the National Council of Teachers of Mathematics has prepared *Assessment Standards for School Mathematics* (1995), generally called the "NCTM Assessment Standards," for mathematics assessment?

______ Yes, I am very well aware of the Assessment Standards.

______ Yes, I have read parts of the Assessment Standards, or have read about the Assessment Standards.

______ Yes, I have heard of the Assessment Standards, but I don't know very much about them.

______ No, I am not aware of the Assessment Standards.

Comments:

5. To the extent that you are aware of the NCTM Standards documents, what is your overall impression? Is it positive or negative?

Would you say that you:

______ feel they are acceptable?

______ feel they are effective? ______ feel they have had the intended impact?

______ feel they are practical? ______ impractical?

______ would use them?

______ feel they would require too much time ______ to prepare? ______ in class?

______ feel they would require too much technical skill or training to use them?

______ feel they would be too difficult to implement?

______ feel they are <u>necessary</u> for teachers at the K-12 level but not at the college or university level?

______ feel they are <u>useful</u> for teachers at the K-12 level but not at the college or university level?

______ feel they are an <u>acceptable</u> manner of being a professional in your <u>department</u>? ________ or at the college or university level?

______ feel they are a <u>necessary</u> manner of being a professional in your <u>department</u>? ________ or at the college or university level?

6. In your judgment, to what extent are the other mathematics faculty in your department aware of, or knowledgeable about, the NCTM Standards documents?

The NCTM Standards?

Not at all aware	Very limited awareness	Somewhat aware	Moderate awareness	Very aware

If you are uncertain, check here: ____.

If you feel you have no basis for judgment, check here: ____.

7. The NCTM Professional Teaching Standards?

Not at all aware	Very limited awareness	Somewhat aware	Moderate awareness	Very aware

If you are uncertain, check here: ____.

If you feel you have no basis for judgment, check here: ____.

8. The NCTM Assessment Standards?

Not at all aware	Very limited awareness	Somewhat aware	Moderate awareness	Very aware

If you are uncertain, check here: ____.

If you feel you have no basis for judgment, check here: ____.

8. Are you aware of the work and publications by the MAA and the NRC relating to learning and teaching mathematics?

Moving Beyond Myths

A Call for Change

Reshaping College Mathematics?

Comments:

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Awareness, Beliefs, and Classroom Practices of Mathematics Faculty at the Collegiate Level

Author(s): Victoria Boller LaBerge, Alan Zollman, and Linda R. Sons

Corporate Source: Northern Illinois University

Publication Date: March 26, 1997

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic/optical media, and sold through the ERIC Document Reproduction Service (EDRS) or other ERIC vendors. Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following two options and sign at the bottom of the page.

☒ **Check here For Level 1 Release:** Permitting reproduction in microfiche (4" x 6" film) or other ERIC archival media (e.g., electronic or optical) *and* paper copy.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Level 1

The sample sticker shown below will be affixed to all Level 2 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Level 2

☐ **Check here For Level 2 Release:** Permitting reproduction in microfiche (4" x 6" film) or other ERIC archival media (e.g., electronic or optical), but *not* in paper copy.

Documents will be processed as indicated provided reproduction quality permits. If permission to reproduce is granted, but neither box is checked, documents will be processed at Level 1.

"I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic/optical media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries."

Sign here→ please

Signature: Victoria Boller LaBerge, Alan Zollman, Linda R. Sons

Printed Name/Position/Title: Victoria Boller LaBerge, Alan Zollman and Linda R. Sons

Organization/Address: Department of Mathematical Sciences, Northern Illinois University, DeKalb, IL 60115

Telephone: 815-753-6756

FAX: 815-753-1112

E-Mail Address: laberge@math.niu.edu

Date: April 2, 1997

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

~~Science, Mathematics, and Evnironmental Education~~
~~1200 Chambers Road~~
~~The Ohio State University~~
~~Columbus, OHIO 43212~~

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
1100 West Street, 2d Floor
Laurel, Maryland 20707-3598

Telephone: 301-497-4080
Toll Free: 800-799-3742
FAX: 301-953-0263
e-mail: ericfac@inet.ed.gov
WWW: http://ericfac.piccard.csc.com

(Rev. 6/96)